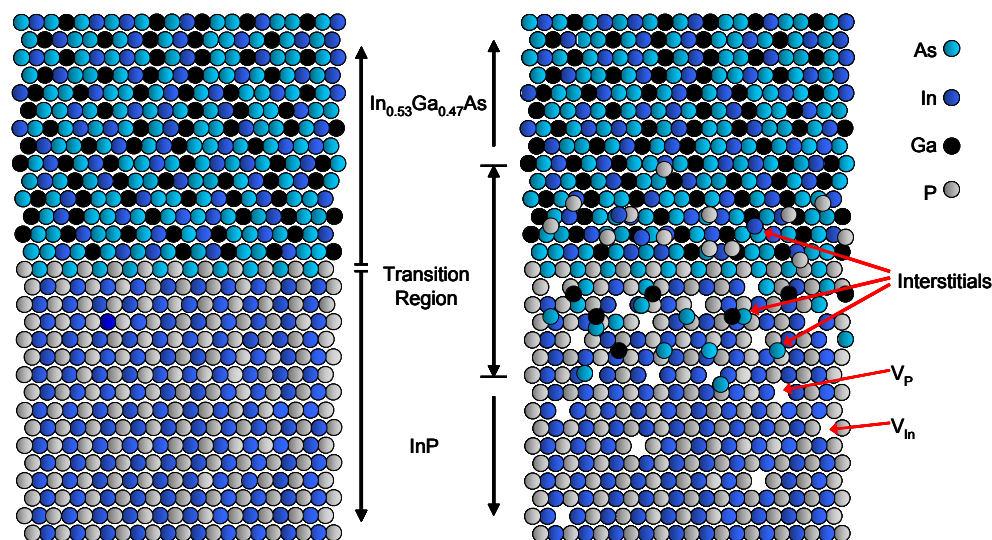


Effects of Epitaxial Growth Transitions on Atomic and Electronic Structure Near InGaAs/InP Heterojunctions

Len Brillson, Steve Ringel, Jon Pelz, & John Wilkins, Ohio State

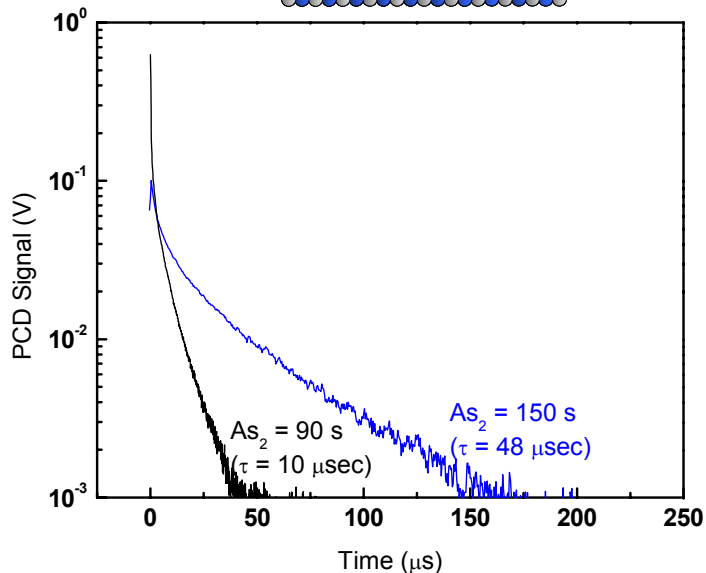
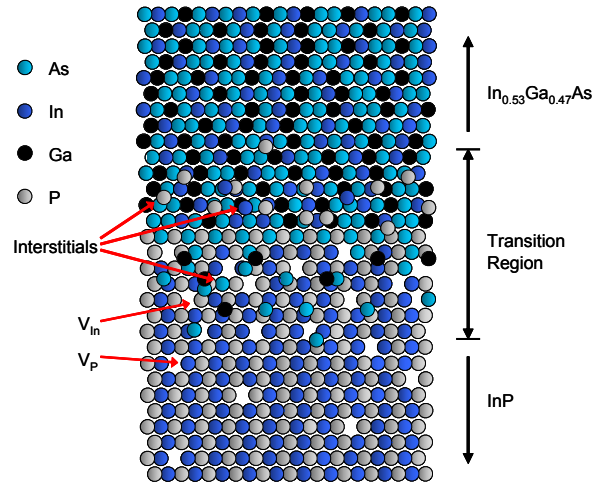
University, DMR-0076362

Advanced electronics for communication, sensors, power generation, illumination, and display all rely on the creation of crystals whose atomic arrangements can be controlled on a monolayer scale. Attaining near-perfection in the epitaxial growth of one ordered semiconductor lattice to another requires a detailed understanding of how the atoms move and link up as the individual layers grow. The sequence of growth steps influences not only the abruptness of this transition but also what electronic traps and barriers to charge transport are present. Controlled variations in epitaxial growth combined with a complement of chemical, electronic, and structural probes reveal the exquisite balance of growth processes required to create state-of-the-art semiconductor heterojunctions.

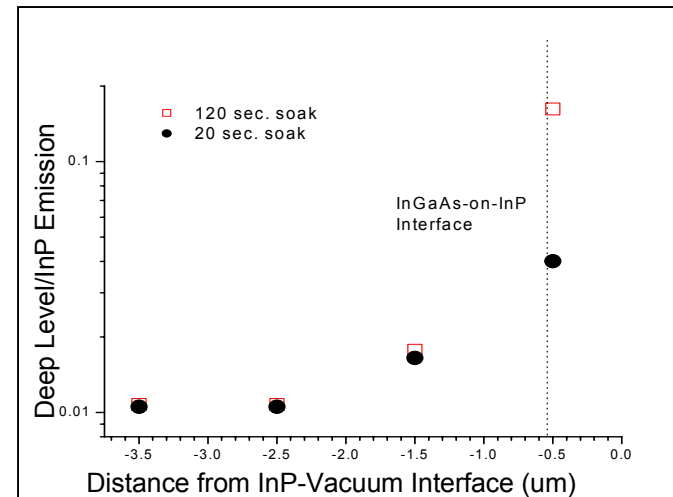
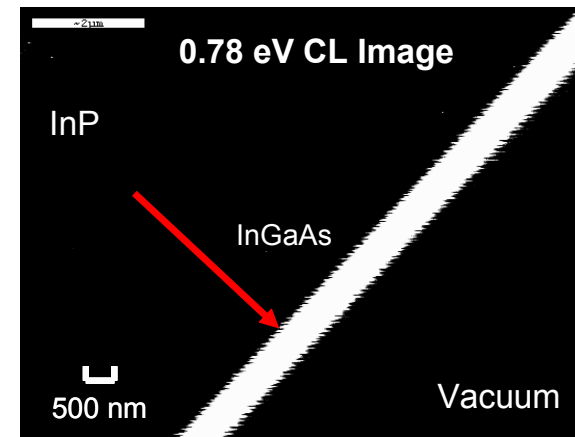


Atomically-ordered InGaAs/InP heterojunction showing nano-scale transition region nearly abrupt (left) or with both anion and cation interdiffusion (right) as measured by SIMS. Outdiffusing P and In produce InP defect emission increasing toward transition zone.

Impact of Nanoscale Control of Heterojunction Atomic Disorder



Photoconductive decay after infrared excitation from an InP/InGaAs/InP quantum well grown with intentionally different atomic-scale interface structures



Increased InP point defect micro-cathodoluminescence intensity with proximity to an InP/InGaAs/InP quantum well interface grown with intentionally different atomic-scale interface structures

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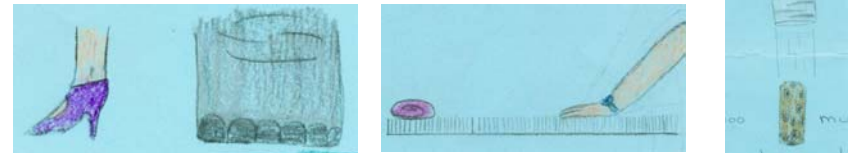
Education:

An undergraduate REU student (Adam Champion) and three graduate students of Jon Pelz (Kibog Park, Yi Ding, and Cristian Tivarus) contributed to this work. Yi Ding will graduate this Fall, and Adam Champion continues his undergraduate studies.

Outreach:

In addition to giving lab tours to high school students and other visitors, the PI presents yearly Physics demonstrations in elementary school classrooms (1st – 6th Grade). He has also worked with elementary school teachers to help prepare them (and their students) for the State Proficiency tests.

Artwork from 5th grade student Hannah: Spiked heal, elephant foot, bed of nails, liquid-nitrogen rocket help to understand *pressure*. “... It’s marvelous how science and technology work together to revolutionize the way we live.”



From her teacher: “The kids absolutely lit up when I asked about your visit. The rocket, the bed of nails and the floating magnet- all sounded terrific. Best of all they were able to give me some pretty solid specifics as to the science behind each one.”



From visit to a 2nd grade classroom. The air in the balloon will soon “shrink” in liquid nitrogen.